Maryland
Artist/Teacher Institute

Arts Integrated Lesson Plan

ART FORM:
Visual Art

SUBJECT AREA:
Science, Mathematics,
Reading/English Language Arts

Lesson Title: **Geodesic sphere**	Grade: 4
Contributor, School: Linda Goodale, Calvert Elementary School	Time Frame: Four 45-minute sessions

State Curriculum Content Standards, Indicators, Objectives

Visual Art Content Standard(s)	**Science Content Standard(s)**
1.0 Perceiving and Responding: Aesthetic Education Students will demonstrate the ability to perceive, interpret, and respond to ideas, experiences, and the environment through visual art. 2.0 Historical, Cultural, and Social Context Students will demonstrate an understanding of visual art as an essential aspect of history and human experience. 3.0 Creative Expression and Production Students will demonstrate the ability to organize knowledge and ideas for expression in the production of art.	Life Science 3.0 Students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time. Environmental Science 6.0 Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective. **Mathematics Content Standard(s)** Knowledge of Geometry 2.0 Students will apply the properties of one-, two-, or three-dimensional geometric figures to describe, reason, or solve problems about shape, size, position, or motion of objects. **Reading/English Language Arts Content Standard(s)** Comprehension of Literary Text 3.0 Students will read, comprehend, interpret, analyze, and evaluate literary texts.
Visual Art Content Indicator(s) 1.1 Identify, describe and interpret observed form. 2.2 Explain differences between and among historical, social, or cultural reasons for creating and using art by studying artworks and other sources of information. 3.2 Investigate a variety of ways that artists develop ideas and organize the elements of art in response to what they see, know, and feel.	**Science Content Indicator(s)** Topic A: Diversity of Life 3. A.1 Explain how animals and plants can be grouped according to observable features. Topic F: Ecology 3. F.1 Explain the ways that individuals and groups of organisms interact with each other and their environment. Topic B. Environmental Issues 6. B.1 Recognize and describe that people in Maryland depend on, change, and are affected by the environment. **Mathematics Content Indicator(s)** Topic B: Solid Geometric Figures 2. B.1 Analyze the properties of solid geometric forms.

	2. B.2 Analyze the relationship between plane geometric figures and surfaces of solid geometric figures. **Reading/English Language Arts Content Indicator(s)** 3.1 Develop comprehension skills by reading a variety of self-selected and assigned literary texts, including print and non-print texts. 3.2 Use text features to facilitate understanding of literary texts.
Fine Arts Content Objective(s) 1.b Represent relationships among observed people, animals, and objects in a composition by selecting and using the elements of art to achieve specific effects. 2.a Identify technologies, processes, and materials used to create visual art. 2.b Describe the origins of selected technologies, processes, and materials used in the visual arts. 3..a Describe sources for ideas and compare the processes used to create artworks based on those sources.	**Science Content Objective(s)** 3.A.1.a Observe and compile a list of a variety of animals or plants in both familiar and unfamiliar environments 3.F.1.a Identify and describe the interactions of organisms present in a habitat. • Competition for space, food, and water • Beneficial interactions: nesting, pollination, seed dispersal, oysters filtering, as in the Chesapeake Bay, etc. • Roles within food chains and webs: scavengers, decomposers, producers, consumers 6.B.1.a Identify and describe that human activities in a community or region are affected by environmental factors. • Presence and quality of water • Soil type • Temperature • Precipitation **Mathematics Objectives** 2.B.1.b Describe solid geometric figures by the number of edges, faces, or vertices. 2.B.2.b Compare a plane figure to surfaces of solid geometric figure **Reading/English Language Arts Content Objective(s)** 3.1. b Listen to critically read and discuss a variety of literary forms and genres. Objective a. Identify how organizational aids such as the title of the book, story, poem, or play contribute to meaning. 3.2 b Identify how graphic aids such as pictures and illustrations, punctuation, and print features contribute to meaning. 3.2.c Identify and explain how informational aids such as introductions and overviews, materials lists, timelines, captions, glossed words, labels, numbered steps, bulleted lists, footnoted words, pronunciation keys, transition words, end notes, works cited, and other informational aids encountered in informational texts contribute to meaning.
Objective(s) (Connecting the content areas) Students will use research strategies to create an illustration to express scientific concepts related to an animal or plant and its environment. Students will use sculptural techniques to create geometric three-dimensional forms to illustrate the food chain.	

Key Art Vocabulary
illustration, three-dimensional

Key Science Vocabulary
- *biodiversity*—the range of organisms present in a given ecological community or system
- *biome*—a division of the world's vegetation that corresponds to a particular climate and is characterized by certain types of plants and animals, e.g., tropical rain forest or desert
- *ecology*—the study of the relationships and interactions between living organisms and their natural or developed environment
- *environment*—relating to the natural world, especially to its conservation, or an animal's surroundings
- *food chain*—a hierarchy of different living things, each of which feeds on the one below it

Key Mathematics Vocabulary
- *geodesic*—the shortest line between two points on a mathematically defined surface

Prior Knowledge Students Need for This Lesson

Art
- Students need familiarity with drawing natural objects from observation.
- Students should understand basic composition elements to apply to their drawings.

Reading/ Language Arts
- Students need to know how to get information from a variety of sources: books, diagrams, illustrations, and web sites

Materials and Resources

Materials and Resources for the Class
- *Just a Dream* by Chris Van Allsburg
- 30 sheets of recycled drawing or construction paper
- 30 large cardboard tubes (recycled from laminator film)
- Fine black and/or colored markers
- Heavy yarn or twine or fishing line
- Toothpicks and dried peas
- Teacher-created worksheets based on research information

Materials and Resources for the Teacher
Linnaeus devised a system for classifying plants and animals under two names, one referring to the genus and one to the species.

Nonfiction
Smith, A.G. (1986). *3-D Geometrical Shapes*. New York: Dover Publications.
Pollock, S. (1993). *Ecology*. London: Doeling Kindersley.
Fullick, A. (2000). *Ecosystems & Environment.*, Des Plaines, Illinois: Heinemann Library.
Fiction
Van Allsburg, Chris. (1990). *Just a Dream*. New York: Scholastic.

Web sites
www.epa.gov
www.4cleanair.org

Animal cards

Lesson Development/Procedures (including motivation, modeling, guided practice, and independent practice)

- Read the story *Just a Dream* by Chris Van Allsburg and discuss it with the class. What additional information is found in the illustrations which are not in the text? Why didn't the artist use captions? In

some of Van Allsburg's books (e.g., *Two Bad Ants*), he likes to use an unusual point of view. Is there a particular point of view in *Just a Dream?* Why, or why not? Compare this point of view to that in *We Will Miss Them* by Alexandra Wright. Do the books have a similar theme? How are the themes different?

- Have the class brainstorm and make a list of thirty (or more) different species of plants and animals.
- Allow each student to select a card (one of thirty, made by the teacher from the list, each containing the name of a different type of living species). Students may trade with one another if they wish, but each student must do a different task.
- Give each student a sheet of white drawing paper and explain that they are to create a composition in pencil, made up of drawings of examples of their types of plants or animals. They are allowed to use reference materials to draw from (the teacher will have a variety of books, encyclopedias, magazines, photographs, leaves, shells, pinecones, etc. , available, or Web sites may be consulted). Each student is asked to write a brief description of the species and its environmental needs and identify other species that it may interact with. (Use worksheets made in advance by the teacher.)
- After students have completed compositions in pencil on the drawing paper, they may use markers to outline their drawings. Finished drawings may be photocopied for display.
- Each student is then given a cardboard tube and asked to glue his/her drawings around it, using rubber bands to hold the drawings in place until the glue is dry. The drawing paper should be pre-cut to fit the tube exactly.
- Ask the students: "What is the strongest shape?" Hand out a number of polygons made from tag board strips with paper fasteners at the corners (made in advance by the teacher). Allow the students to manipulate the different shapes—square, triangle, hexagon, pentagon, octagon, decagon, etc. (Eventually, they will realize that the more sides a plane figure has, the weaker it is and that, therefore, the triangle is the strongest geometric shape. This is why triangular figures are seen so often in bridges and as reinforcements in all types of structures).
- Provide examples of geometric solid shapes. Have the students identify the plane shapes of the sides and guess the number of sides of each solid. Distribute the toothpicks and the dried peas (which have been soaked overnight) to all the students and have them create geometric solid forms by using the peas to hold the toothpicks together at the corners. When the peas dry, the students can take them home. Then have the students draw how the geometric form would look flattened on a piece of paper. Make sure that all sides are shown. Show pictures of the work of R. Buckminster Fuller, especially his geodesic domes. Discuss his ideas.
- Have the students lay out the completed tubes on the tables and try to form connections between the species, as in a food chain or web of interdependence. For example, join the bear tube to the salmon-type fish tube. Try to lay out all the tubes into the shape of a flattened dodecahedron. Use heavy yarn threaded through the decorated cardboard tubes to tie them together to form triangles. Then tie all the triangles together to make a geodesic sphere. When joining the decorated tubes, have the students try to make connections between the species. Hang the finished products from the ceiling.
- Using tissue paper or cellophane, have the students cut out the shapes of the continents in the geodetic manner described by Fuller and attach them to the biodiversity sphere so that the underlying drawings will show through.

Closure/Summary

Students share work with the class and discuss why they connected their pieces in relationship to the food chain.

Assessment (Description/Tools)

Fine Arts Assessment (Description/Tools)

The students' drawings will be assessed for:

- Use of several sources for research on the selected species.
- Accuracy in drawing the subjects.
- Drawing several variations (or poses) of the species.
- Arranging the images in an interesting composition.

Reading/Language Arts Assessment (Description/Tools)

Students will be assessed on their understanding of the story by their responses and discussion.

Mathematics Assessment (Description/Tools)
Students' geometric solid models and their explanatory drawings will be used to assess their understanding of geometric forms.

Science Assessment (Description/Tools)
Worksheets will be assessed for accuracy and completeness.

Lesson Extensions
None